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QA Inspections Via Condition Monitoring

Guidelines for Quality Assurance Inspection of Commercial Activities Contracts for Real Property Maintenance Activities

Guide #6: Ventilation, Air Conditioning, and Refrigeration Systems

by
James H. Johnson
Paul C. Bresnahan

A Quality Assurance (QA) Program allows the Army to evaluate and document a contractor's work performance. It depends on a QA Surveillance Plan (QASP). The QASP, which is based on the contract Performance Work Statement, lists contractor activities and the surveillance approach, number of items to be inspected, and an Acceptable Quality Level (AQL) for each activity. This series of 12 guides will help the Contracting Officer's Representative/Quality Assurance Evaluator by defining and clarifying the inspection tasks required by the QASP, which will facilitate inspection uniformity and effectiveness.

This guide discusses QA monitoring of ventilation, air conditioning, and refrigeration systems operations and maintenance.

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FOREWORD

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The work was performed by the Facility Management Division (FF) of the Infrastructure Laboratory (FL), U.S. Army Construction Engineering Research Laboratories (USACERL). Alan W. Moore is Acting Chief, CECER-FF, and Dr. Michael J. O'Connor is Chief, CECER-FL. Special appreciation is expressed to Robert D. Neathammer, CECER-FF, and John H. Williamson, formerly of CECER-FF, for their contributions. The USACERL technical editor was Linda L. Wheatley, Information Management Office.

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**GUIDELINES FOR QUALITY ASSURANCE INSPECTION OF COMMERCIAL ACTIVITIES
CONTRACTS FOR REAL PROPERTY MAINTENANCE ACTIVITIES
GUIDE #6: VENTILATION, AIR CONDITIONING, AND REFRIGERATION SYSTEMS**

1 INTRODUCTION

Background

A Quality Assurance (QA) program allows the Army to evaluate and document a contractor's performance. The Quality Assurance Evaluator (QAE) conducts skilled and carefully planned inspections aimed at verifying the satisfactory completion of contractor work. The inspections evaluate the quality, quantity, and timeliness of the services provided, not the contractor's methods used in performing the work. A good QA program promotes the best possible product within the terms of the standing contract.

A well organized QA program depends on a QA Surveillance Plan (QASP), which is prepared by the Government and contains the purpose and methods of the QA program. Although the QASP is not a part of the contract, it is based on the contract Performance Work Statement, which is part of the contract. The QASP lists contractor activities and the surveillance approach, approximate number of items to be surveyed, and an Acceptable Quality Level (AQL) for each activity.

The installation Director of Public Works (DPW), the Contracting Officer (KO), or the Contracting Officer's Representative (COR) often oversees the QASP. The COR/QAE needs an inspection guide to help define and clarify the inspection tasks required by the QASP, and to facilitate inspection uniformity and effectiveness. To meet this need, the U.S. Army Construction Engineering Research Laboratories (USACERL) developed this series of 12 inspection guides.

Objective

This guide series is intended to supplement any existing QASP and to provide QA guidance for evaluating Operations and Maintenance (O&M) work as performed by contractors on Army property. This ventilation, air conditioning, and refrigeration (VAC&R) systems guide contains recommended surveillance methods that can be amended by direction of the KO or QA management to fit the needs of a specific installation.

Guide Series Organization

This series includes the following guides by USACERL published in October 1993:

- #1: Water Systems (Special Report [SR] FF-94/01)
- #2: Wastewater Systems (SR FF-94/02)
- #3: Natural Gas Distribution Systems (SR FF-94/03)
- #4: Electrical Systems (SR FF-94/04)
- #5: Heating Systems (SR FF-94/05)
- #6: **Ventilation, Air Conditioning, and Refrigeration Systems**
- #7: Building Services (SR FF-94/07)
- #8: Grounds Maintenance (SR FF-94/08)

- #9: Surfaced Areas (SR FF-94/09)
- #10: Refuse and Recyclable Handling (SR FF-94/10)
- #11: Pest Control Services (SR FF-94/11)
- #12: Custodial Services (SR FF-94/12).

The QAE is expected to evaluate a contractor's performance by applying appropriate visual and instrumentation procedures along with necessary technical and interpretive skills. This guide covers QAE inspection of ventilation, air conditioning, and refrigeration systems, and is divided into sections that take the inspector through a step-by-step process of recommended performance indicators, inspection tasks, and surveillance methods.

VAC&R systems are divided into two subsystems in this guide:

1. VAC&R Operations
2. VAC&R Maintenance.

General QA information, including detailed explanations of the available surveillance methods, is given in Chapter 2.

Chapter 3 provides performance indicators, inspection tasks, and recommended surveillance approaches for each subsystem.

Appendix A contains sampling inspection tables. Appendix B contains QAE Worksheets for each subsystem and a service order questionnaire; they may be reproduced for field use.

2 GENERAL QA INSPECTION INFORMATION

Inspection Organization and Planning

According to custom and standard practice, the contractor submits copies of the previous month's O&M activities and regulatory agency reports to the COR and the QAE. The due dates of these reports control the start of inspection scheduling. If possible, the QAE's inspection should be conducted within 3 days after receiving the reports. Effective coordination will allow more efficient inspection of services. The COR/QAE should look for specific indicators of the contractor's performance and should evaluate that performance based on Detailed Inspection Tasks. The following chapter lists the Performance Indicators and Detailed Inspection Tasks for ventilation, air conditioning, and refrigeration systems.

Quality Assurance Surveillance Methods

The QAE can use the following five surveillance methods to determine contractor performance:

1. Random Sampling
2. Planned Sampling
3. 100 Percent Inspection
4. Unscheduled Inspection
5. Customer Complaints.

Random Sampling

The methods are based on statistical criteria provided in Military Standard (MIL-STD)-105E, *Sampling Procedures and Tables for Inspection by Attributes* (10 May 1989) and are presented as recommendations. The methods used should be based on the unique needs of an individual system. Generally, all five methods are not used to evaluate an individual system.

Random sampling is recommended for situations where many work items are candidates for inspection. For instance, because it is impractical to inspect every roof on an installation with 500 buildings, only a select number of the buildings should be inspected. Likewise, in random sampling, only a portion of the total performed work is inspected. Acceptance of the work is based on the assumption that the inspected items are representative of the quality of the contractor's work. The random sampling technique spreads the selected samples evenly throughout the evaluation period. The following are steps to be used by the QAE in random sampling.

Tables A1 and A2 in Appendix A should be used to determine the number of samples to be inspected and the number of rejects allowed as a function of the number of inspected work items for AQLs of 4 and 10 percent, and the level of surveillance. The three levels of surveillance are: normal, increased (tightened), and reduced. Initially, this guide recommends normal surveillance for random sampling. However, under the direction of the KO, the level of surveillance can be changed depending on the contractor's performance.

As an example, assume that the contractor's total scheduled output (i.e., population size) for a particular work item is 125 units and that the normal surveillance level with an AQL of 4 percent has been selected. According to Table A1, 20 of the 125 units of work should be inspected, and the entire output of 125 units should be rejected if 3 or more of the 20 sample units are not acceptable.

The QA Worksheets in Appendix B provide room to record the population size, the number of samples, the maximum number of rejects, and the interval for each Performance Indicator.

The work planned by the contractor for each maintenance task should be listed by date to make it easier to predict the time when the work samples will be ready for inspection.

Planned Sampling

Evaluation by planned sampling inspects some, but not all, of the work activities and is appropriate when the number of work items is large. Some items are evaluated before scheduled completion because they are inaccessible after the work is completed. The COR/QAE subjectively selects key work items for inspection; the sample size is determined arbitrarily.

The COR/QAE will normally use planned sampling when the contractor's performance at selected locations or tasks is poor. With this type of evaluation, the contractor knows that work performed in these areas is more likely to be monitored. Planned sampling provides a systematic way of focusing on specific output and forming conclusions about the contractor's performance level.

100 Percent Inspection

Inspection at 100 percent requires total inspection of all items in a contract requirement. It is normally used to monitor infrequent work or critical contract work when the number of work items is small and in cases where nonperformance could seriously damage Army-furnished equipment or processes. It may also be used in areas where a contractor has had prior performance difficulties.

Unscheduled Inspection

Unscheduled inspections can be used for areas of poor past contractor performance, noncritical areas, areas of infrequent repairs, or as a follow-up check of previous inspections. If the QAE notices such an area, an unscheduled inspection can be conducted to evaluate contractor performance.

Customer Complaints

The customer complaint method is based on an informed and cooperative customer population, that is generally aware of local contract requirements. Customers are expected to monitor contractor services and, when performance is poor or nonexistent, to notify the COR/QAE. If investigation reveals that the complaint is valid, the COR/QAE documents the deficiency. Since this is a reactive QA inspection approach, this method of surveillance normally supplements planned inspection methods.

Increased Surveillance

For areas of poor past contractor performance, the QAE should consult with the KO to intensify the surveillance method. More than one option is usually available, and selection should be based on the initial method and the amount of work performed.

1. Random Sampling (Normal Surveillance) can be replaced by:

- Random Sampling (Increased Surveillance)
- Planned Sampling (for a large population size)

- 100 Percent Inspection (for a small population size)
 - Unscheduled Inspection (for any population size).
2. Planned Sampling can be replaced by:
- Random Sampling (Normal Surveillance)
 - 100 Percent Inspection (for a small population size)
 - Unscheduled Inspection (for any population size).
3. Unscheduled Inspections can be replaced by:
- 100 Percent Inspection (for a small population size)
 - Random Sampling (Normal Surveillance)
 - Planned Sampling.

Decreased Surveillance

For work areas in which the contractor maintains a consistently satisfactory performance for 3 to 6 months, the QAE should consult with the KO to decrease the intensity of the surveillance. More than one option is usually available and selection should be based on the initial method and the amount of work performed.

1. Random Sampling (Normal Surveillance) can be replaced by:
- Random Sampling (Reduced Surveillance)
 - Planned Sampling
 - Unscheduled Inspection (for any population size)
 - Customer Complaints.
2. Planned Sampling can be replaced by:
- Unscheduled Inspection (for any population size)
 - Customer Complaints.
3. 100 Percent Inspection can be replaced by:
- Random Sampling (Normal Surveillance)
 - Random Sampling (Reduced Surveillance)
 - Planned Sampling
 - Unscheduled Inspection (for any population size)
 - Customer Complaints.

3 VAC&R SYSTEM QA INSPECTIONS

VAC&R Operations

Performance Indicators and Detailed Inspection Tasks

The following numeric items are performed by the contractor. The related detailed inspection tasks are used by the QAE to verify the contractor's performance.

1. All required operations documentation is complete, adequate, and timely.

Verify that the contractor's operations documentation is complete, adequate, and timely. Examine the daily log of operations monthly to identify possible operational deficiencies such as wide temperature shifts and questionable data. Document any deviations from the usual so that the KO can review them and ask the contractor for explanation or justification.

2. Computer rooms have proper air flow and are kept at 68 °F (± 2 °F)* and at a relative humidity equal to or less than 50 percent.

Verify that computer rooms have proper air flow and are kept at 68 °F (± 2 °F) and at a relative humidity equal to or less than 50 percent. If the space cannot be entered because of security restrictions, check the temperature and humidity by obtaining the information from the person responsible for each facility. Document any discrepancies.

3. Food and medical storage units are kept at their required temperatures.

Verify that food and medical storage units are kept at their required temperatures. QA instrumentation is recommended to check for the required temperatures (Johnson 1993). Document any discrepancies.

4. General-purpose rooms have proper air flow and are kept at ambient temperatures of approximately 78 °F in the summer and 68 °F in the winter.

Verify that general-purpose rooms have proper air flow and are kept at ambient temperatures of approximately 78 °F in the summer and 68 °F in the winter. QA instrumentation is recommended to check for the required temperatures and air flow (Johnson 1993). Document any discrepancies.

5. "As-built" drawings are updated with changes and corrections.

Verify that the contractor maintains current "as-built" drawings of VAC&R system facilities and equipment. Check to see that the drawings are updated annually with all changes and corrections. The draftperson's initials and the date should accompany each change.

6. An adequate library of equipment manufacturers' manuals is being maintained.

*°F = (°C + 17.78) × 1.8.

Verify that the contractor maintains an adequate library of manufacturers' manuals for equipment and facilities. Manuals should be obtained for newly installed equipment and obsolete manuals should be discarded.

Recommended Surveillance Approach

- Evaluate performance indicators #1, #2, and #3 monthly using the 100 percent inspection method.
- Evaluate performance indicator #4 monthly using random sampling (normal surveillance, 10 percent AQL).
- Evaluate performance indicators #5 and #6 annually using the 100 percent inspection method.

VAC&R Maintenance

Performance Indicators and Detailed Inspection Tasks

The following numeric items are performed by the contractor. The related detailed inspection tasks are used by the QAE to verify the contractor's performance.

1. The Preventive Maintenance Inspection (PMI) reports are complete, legible, and timely.

Verify that the contractor's PMI reports for VAC&R systems are complete, legible, and timely. Document any discrepancies.

2. The Preventive Maintenance (PM) is adequately performed as scheduled for VAC&R systems.

Verify that the contractor's PM program is adequately performed for VAC&R systems. Document any discrepancies between the QAE inspection and the contractor's report of work done.

Evaluate the contractor's PM using the following indicators:

- a. Check to see that compressors, bearings, fans, blower motors, and pumps:
 - (1) Run smoothly and quietly without unusual grinding, scraping, or squealing noises. QA instrumentation is recommended to check for excessive vibration and bearing condition (Johnson 1993).
 - (2) Have sound mechanical linkages and operate freely. QA instrumentation is recommended to check mechanical linkages, including shaft alignment (Johnson 1993).
 - (3) Are adequately lubricated.
 - (4) Do not exhibit abnormally high operating temperatures. QA instrumentation is recommended to check for high operating temperatures (Johnson 1993).
 - (5) Exhibit no oil leaks. QA instrumentation is recommended to check for oil leaks (Johnson 1993).

- (6) Have normal operating oil levels.
- b. All systems are clean, including:
 - (1) Condensor coils, fan blowers, and screens are free of dirt, dust, and lint.
 - (2) Evaporator coils are free of lint, dust, and frost buildup.
 - (3) Inlet air openings, louvers, and screens are free of lint, dirt, leaves, and similar debris.
 - (4) Duct louvers, screens, and grills are free of dirt and debris.
 - (5) Filters are not dirty or clogged.
- c. Control and monitoring lights, gauges, and meters are operative.
- d. Belt tension and alignment are adjusted so that moderate pressure on the belt does not deflect the belt more than 1/4-in. (0.635 cm). Multiple belts have equal tension and run true in pulley sheaves. Belts show no excessive wear.
- e. There are no refrigerant leaks. QA instrumentation is recommended to check for refrigerant leaks (Johnson 1993).
- f. There are no air leaks in the VAC&R system. QA instrumentation is recommended to check for system air leaks (Johnson 1993).
- g. Replacement duct insulation is 1-in. (2.54-cm) thick and forms a continuous vapor barrier.
- 3. The contracted Service Order (SO) and Individual Job Order (IJO) work is done in a timely, effective, and professional manner.

Verify that the contracted SO and IJO work is done in a timely, effective, and workmanlike manner. The overall quality and appearance of the repair, including materials, must be comparable to the facility's original construction quality and appearance. Document any discrepancies between the QAE inspection and the contractor's report of work completed.

Visit the site of the selected repair to verify that the work is being performed with minimal service interruptions. After completion of the repair work, check to see that the construction area is clear of debris.

Recommended Surveillance Approach

- Evaluate performance indicator #1 monthly using the 100 percent inspection method.
- Evaluate performance indicator #2 monthly using random sampling (normal surveillance, 10 percent AQL).
- For performance indicator #3, evaluate SOs monthly using random sampling (normal surveillance, 4 percent AQL), and evaluate IJOs monthly using the 100 percent inspection method.

ACRONYMS

AQL	Acceptable Quality Level
COR	Contracting Officer's Representative
DEH	Director of Engineering and Housing
KO	Contracting Officer
MIL-STD	Military Standard
O&M	Operations and Maintenance
QA	Quality Assurance
QAE	Quality Assurance Evaluator
QASP	QA Surveillance Plan
VAC&R	ventilation, air conditioning, and refrigeration

REFERENCES

Johnson, James, Special Report FF-93/DRAFT, *Catalog of Industrial Instrumentation for Army Real Property Quality Assurance Applications* (U.S. Army Construction Engineering Research Laboratory, 1993).

Military Standard 105E, *Sampling Procedures and Tables for Inspection by Attributes* (Department of Defense, 10 May 1989).

APPENDIX A: Inspection Sampling Tables

Table A1

Sample Sizes and Reject Levels (4% AQL)
(As developed from Tables I & II in MIL STD 105E)

Population Size	Normal Surveillance			Increased (Tightened) Surveillance			Reduced Surveillance		
	Class II Sample Size	Reject Level		Class III Sample Size	Reject Level		Class I Sample Size	Reject Level	
08 to 50	*	25%	1	*	40%	1	*	-	-
51 to 90	E	13	2	F	20	2	*	3%	1
91 to 150	F	20	3	G	32	3	*	3%	1
151 to 280	G	32	4	H	50	4	E	5	2
281 to 500	H	50	6	J	80	6	F	8	3
501 to 1200	J	80	8	K	125	9	G	13	4
1201 to 3200	K	125	11	L	200	13	H	20	5

The Reject Level is the number of failed inspections requiring rejection of the Lot (population).
An asterisk (*) indicates that the sample level is outside the range of a 4% AQL for the selected class.

Table A2

Sample Sizes and Reject Levels (10% AQL)
(As developed from Tables I & II in MIL STD 105E)

Population Size	Normal Surveillance			Increased (Tightened) Surveillance			Reduced Surveillance		
	Class II Sample Size	Reject Level		Class III Sample Size	Reject Level		Class I Sample Size	Reject Level	
06 to 15	*	33%	1	*	50%	1	*	-	-
16 to 25	C	5	2	D	8	2	*	8%	1
26 to 50	D	8	3	E	13	3	C	2	2
51 to 90	E	13	4	F	20	4	C	2	2
91 to 150	F	20	6	G	32	6	D	3	3
151 to 280	G	32	8	H	50	9	E	5	4
281 to 500	H	50	11	J	80	13	F	8	5
501 to 1200	J	80	15	K	125	19	G	13	6
1201 to 3200	K	125	22	L	200	19	H	20	8

The Reject Level is the number of failed inspections that require rejection of the Lot (population).
An asterisk (*) indicates that the sample level is outside the range of a 10% AQL for the selected class.

Table A3
Random Numbers

2	6	1	6	9	3	5	5	1	1	3	1	2	5	5	1	7	8	7	5	6	6	8	4	4	9	4	6	2	8	9	3	5	
1	8	1	4	5	9	2	7	2	2	5	4	9	1	9	2	9	4	9	1	3	2	8	6	3	5	1	4	3	1	1	1	6	1
4	2	3	6	8	4	6	3	2	6	6	8	8	5	4	9	1	1	3	2	8	6	1	9	8	7	1	2	4	3	4	1	3	
2	7	2	4	8	8	8	3	5	3	3	2	6	3	9	3	2	7	7	1	8	3	5	9	6	8	1	5	9	3	2	4	6	
8	4	1	3	7	4	4	6	1	6	9	6	3	7	5	6	2	1	4	3	2	8	5	7	8	2	4	7	7	7	4	2	6	
2	6	4	8	1	5	4	9	7	1	7	3	3	7	2	1	7	4	4	7	7	8	2	7	5	7	6	5	6	6	2	5	8	
1	9	8	6	9	6	8	3	7	5	4	1	3	6	1	1	3	3	2	8	7	5	4	1	9	1	4	9	7	1	8	4	8	
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APPENDIX B: QAE Inspection Worksheets

VAC&R Operations Worksheet

Page 1 of 5

Performance Indicator #1: All required operations documentation is complete, adequate, and timely.

- a. All items are listed, dated, and initialed as completed.

S U N

- b. The checklist is timely.

S U N

- c. No possible operational deficiencies are evident.

S U N

Remarks:

Performance Indicator #2: Computer rooms have proper air flow and are kept at 68 °F (± 2 °F) and at a relative humidity equal to or less than 50 percent.

LOCATION

	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N
	S	U	N

*S = Satisfactory, U = Unsatisfactory, N = Not applicable. Circle one rating for each item.

VAC&R Operations Worksheet

Page 2 of 5

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.[illegible]**Remarks:**

Performance Indicator #3: Food and medical storage units are kept at their required temperatures.

LOCATIONThis image shows a single sheet of white paper with horizontal blue or grey ruling lines, typical of notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.[illegible]

Page 4 of 5

Using the population size_____, and referring to normal surveillance in Tables A1 and A2 gives_____number of samples and_____number of allowable rejects.

[illegible]

19

Performance Indicator #5: "As-built" drawings are updated with changes and corrections.

- a. The draftperson's initials accompany each change.

S U N

- b. The date of change accompanies each correction.

S U N

Remarks:

Performance Indicator #6: An adequate library of equipment manufacturers' manuals is maintained.

- a. Manuals for new equipment have been obtained.

S U N

- b. Obsolete manuals have been properly discarded.

S U N

Remarks:

Quality Assurance Evaluator

Date

Performance Indicator #1: The PMI inspection reports are complete, legible, and timely.

a. The reports are complete and legible.

S U N

b. The reports are timely.

S U N

Remarks:

Performance Indicator #2: The contractor's PM is adequately performed as scheduled for VAC&R systems.

- a. Compressors, bearings, fans, blower motors, and pumps are satisfactory.
- b. All systems are clean.
- c. Control and monitoring lights, gauges, and meters are operative.
- d. Belt tension and alignment is satisfactory.
- e. There are no refrigerant leaks.
- f. There are no air leaks in the VAC&R system.
- g. Replacement duct insulation is adequate.

Using the population size _____, and referring to normal surveillance in Tables A1 and A2 gives _____ number of samples and _____ number of allowable rejects.

LOCATION

_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N
_____	S	U	N

Remarks:

Performance Indicator #3: The contracted SO and IJO work was done in a timely, effective, and professional manner.

- a. The overall quality and appearance of the repair is comparable to that of the facility's original construction.
- b. Work is performed with minimal interruptions.
- c. The construction area is clear of debris.
- d. Excavated areas are graded to match the surrounding area.

Using the population size _____, and referring to normal surveillance in Tables A1 and A2 gives _____ number of samples and _____ number of allowable rejects.

LOCATION	SO/IJO			
_____	_____	S	U	N
_____	_____	S	U	N
_____	_____	S	U	N
_____	_____	S	U	N
_____	_____	S	U	N
_____	_____	S	U	N
_____	_____	S	U	N
_____	_____	S	U	N
_____	_____	S	U	N
_____	_____	S	U	N
_____	_____	S	U	N
_____	_____	S	U	N
_____	_____	S	U	N
_____	_____	S	U	N
_____	_____	S	U	N
_____	_____	S	U	N

Remarks:

Quality Assurance Evaluator

Date

Service Order Questionnaire

Page 1 of 2

This survey should be completed with information from the person having the most contact with maintenance personnel. Please circle the letter of the answer selected or answer in the blanks, as appropriate.

1. Response (in days) to repair requested work:

- a) Excellent response (normal conditions - 7 days)
(emergency conditions - 1 day)
- b) Adequate response (within 2 weeks)
- c) Too long (Approximately how long? ____ days.)

2. Quality of work: (Are you satisfied that quality work was performed?)

Yes ____ No ____ Defect was not fixed ____.

Explain: _____

3. Cleanup of area after repair: (Is area left as clean as it was before work personnel arrived?)

Yes ____ No ____

Comments: _____

4. Efforts of work personnel: (Are you satisfied that the work was performed in a professional, effective manner?)

Comments: _____

5. Attitude of work personnel: (Are they helpful, friendly, courteous, cheerful?)

Comments: _____

6. Do you think this type of repair could be accomplished as "self help" if material and instructions were supplied?

Yes ____ No ____ Maybe ____

7. Remarks: _____

Thank you for your cooperation.

Quality Assurance Evaluator

Date Questionnaire Completed

USACERL DISTRIBUTION

Chief of Engineers
ATTN: CEHEC-IM-LH (2)
ATTN: CEHEC-IM-LP (2)
ATTN: CERD-L

CECPW 22060
ATTN: CECPW-FM-S
ATTN: CECPW-FM
ATTN: CECPW-FB
ATTN: CECPW-FU
ATTN: CECPW-F-DPN

US Army Engr District
ATTN: Library (40)

US Army Engr Division
ATTN: Library (13)

INSCOM
ATTN: IALOG-I 22060
ATTN: IAV-DEH 22186

HQ XVIII Airborne Corps 28307
ATTN: AFZA-DEH-EE

US Army Materiel Cominand (AMC)
Alexandria, VA 22333-0001
ATTN: AMCEN-F
Installations:
ATTN: DEH (19)
Rocky Mountain Arsenal 8002
ATTN: AMCPM-RM
Pine Bluff Arsenal 71602
ATTN: SMCPB-EH

FORSCOM
Forts Gillem & McPherson 30330
ATTN: FCEN
Installations:
ATTN: DEH (23)

National Guard Bureau 20310
ATTN: Installations Div

Fort Belvoir 22060
ATTN: CECC-R 22060

TRADOC
Fort Monroe 23651
ATTN: ATBO-G
Installations:
ATTN: DEH (20)

USARPAC 96858
ATTN: DEH
ATTN: APEN-A

HQ USEUCOM 09128
ATTN: ECJ4-LIE

AMMRC 02172
ATTN: DRXMR-AF
ATTN: DRXMR-WE

CEWES 39180
ATTN: Library

CECRL 03755
ATTN: Library

USA AMCOM
ATTN: Facilities Engr 21719
ATTN: AMSMC-IR 61299
ATTN: Facilities Engr (3) 85613

USAARMC 40121
ATTN: ATZIC-EHA

Military Traffic Mgmt Command
ATTN: MTEA-GB-EHP 07002
ATTN: MT-LOF 20315
ATTN: MTE-SU-FE 28461
ATTN: MTW-IE 94626

Military Dist of WASH
Fort McNair
ATTN: ANEN 20319

Norton AFB 92409
ATTN: Library

Engr Societies Library
ATTN: Acquisitions 10017

Defense Nuclear Agency
ATTN: NADS 20305

Defense Logistics Agency
ATTN: DLA-WI 22304

US Military Academy 10996
ATTN: MAEN-A
ATTN: Facilities Engineer
ATTN: Geography & Envr Engrg

Naval Facilities Engr Command
ATTN: Facilities Engr Command (8)
ATTN: Division Offices (11)
ATTN: Public Works Center (8)
ATTN: Naval Constr Battalion Ctr
93043
ATTN: Naval Civil Engr Service
Center (3) 93043

Tyndall AFB 32403
ATTN: HQAFCEA Program Ofc
ATTN: Engrg & Srvs Lab

US Gov't Printing Office 20401
ATTN: Rec Sec/Deposit Sec (2)

Defense Tech Info Center 22304
ATTN: DTIC-FAB (2)

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